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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/616,372	07/13/2000	Atsushi Komura	1-50	6846

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EXAMINER	
SOUW, BERNARD E	

ART UNIT	PAPER NUMBER
2881	

DATE MAILED: 12/05/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/616,372	KOMURA ET AL.	
	Examin r	Art Unit	
	Bernard E Souw	2881	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 October 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,5-7,9,10,12-14,16-18,20 and 21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,5-7,9,10,12-14,16-18,20 and 21* is/are rejected.

7)☒ Claim(s) *3,10,14 and 21* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07/13/00 with Fig. 3 amended 05/30/03* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Request for Supplemental Office Action

1. The Request for Supplemental Office Action filed 05/27/2003, on the ground that the previous Office Action dated 06/18/2003 has not considered Applicant's Amendment under 37 CFR 1.116 filed 05/30/2003, that has been entered ***late*** (i.e., after the 06/18/2003 Office Action has been mailed out), is granted. The present Office Action is the requested Supplemental Office Action.

Late-Entered Amendment Acknowledged

2. The Amendment filed 05/30/2003 under 37 CFR 1.116 has been entered.

► The specification and Fig.3 have been amended, which also have been fully considered in the present Office Action.

► Applicant's remarks responding to the previous claims rejections have been fully considered in the present Office Action.

Finality Withdrawal of 03/18/2003 Office Action

3. The previous withdrawal of the *finality* of the Office Action dated 03/18/2003 (Paper No.7), stated in the previous Office Action dated 06/18/2003, remains in effect.

In the previous Office Action, a "new Final Rejection" recited on page 2, 2nd paragraph, lines 6-8, was never put into effect, and hence, remains ineffective, since it was not expressly recited in the claims rejections.

However, Applicant has enjoyed ample opportunity to make appropriate amendments to the claims, and/or bring up arguments against the previous rejections, including those raised in the last Office Action dated 06/18/2003. If there is any, this should have been included in Applicant's request for Supplemental Office Action dated 10/17/2003 that has prompted this Office Action. Evidently, such opportunity has been already made use by amending the specification and the figure drawings, as well as by disputing the previous rejections with a remark, as submitted with the Amendment under 37 CFR 1.116, filed 05/30/2003. Consequently, a new Final Rejection is legitimate, insofar as there is no new ground of rejection raised by the examiner beyond those already recited in the last Office Action dated 06/18/2003.

4. No claim amendment has been made in Amendment C filed 05/30/2003. Claims 4, 8, 11, 15, 19 and 22 have been previously cancelled. Therefore, pending in this Office Action are claims 1-3, 5-7, 9, 10, 12-14, 16-18, 20 and 21.

The present Office Action is made with all the suggested amendments being fully considered.

Drawings

5. Fig.3 having been properly amended per Amendment C filed 05/30/2003, the previous objection to drawings is withdrawn.

Information Disclosure Statement

6. Applicant's argument against the Examiner's objection to the information disclosure statement filed 07/13/2000 is persuasive. Therefore, the previous objection is now withdrawn.

Specification

7. The specification having been properly amended, all the previous objections, including those restated in the previous Office Action, are withdrawn, except the one objection regarding the thickness correction formula (2), which stands ***objected*** because the formula does not have the correct unit.

As generally known to one of ordinary skill in the art, a *mathematically correct* empirical formula would be, e.g., $y = a \cdot \ln(1+t) + b$, which reduces to $y=b$ for $t=0$, or even better, $y = a \cdot \ln(1+t/t_0) + b$, in view that function $\ln(x)$ must be rigorously of a dimensionless argument "x" (see a correct formulation in the newly cited Prior Art, Bozada et al. USPAT # 6,004,881, Eq. 1 in Col.6/ll.35-36, in which the unit of t is unambiguously specified). Another acceptable variant is given by Salmon et al. (Materials at High temperatures ***17***(2), pg. 272, Eq. 2, adopted from earlier dated references [4] and [5]), in which the factor "***a***" assumes the dimension of $[time]^{-1}$.

Withdrawal of Previous 35 U.S.C. § 101

8. The previous § 101 rejections of claims 3, 10, 14 and 21 are now withdrawn. However, the claims are still ***objected*** for reciting a formula that is mathematically incorrect, specifically with regard to the physical units (see the above recited objection to the specification).

35 U.S.C. § 112 Objections

9. The previous rejections of claims 3, 10, 14 and 21 under 35 U.S.C. § 112/¶.1 are now withdrawn, NOT because of Applicant's arguments or Applicant's disclosure, but simply because what Applicant really means beyond the previous § 112 rejection is well known in the art. However, claims 3, 10, 14 and 21 are still objected under the same paragraph.

In the remarks dated May 30 Applicant has misunderstood the previous § 112/¶.1 rejections: It was Applicant's claim language, reciting "***a*** *is a constant determined based on atmosphere around the oxide film*", which is ***objected*** (previously rejected), since it simply does not make sense. What makes sense would be "***a*** *is a constant determined [~~based on~~]* ***by the*** *atmosphere around the oxide film*".

It is well known to one of ordinary skill in the art that the constant "a" *can be determined empirically*. It is also well known in the art that the constant "a" *depends on the atmospheric conditions around the sample*. But it is misleading to claim that Applicant determines the constant "a" "*based on atmosphere*", because –firstly--

Applicant does not disclose the method in the specification, and –secondly-- one of ordinary skill in the art also knows that Applicant will not able to do so, as claimed, i.e., as literally understood from Applicant's claim language.

Claims 3, 10, 14 and 21 stand objected, also because the claim language defines "b" as being *already known* as the *real* thickness of the oxide film, as recited in the claim, as well as in the specification, pg. 10, lines 3-4, and further confirmed by Amendment 6/a, page 3, line 8, "*The constant b is a thickness of the oxide film measured immediately after the gate oxide film 8 is formed*". Applicant has not answered the Examiner's crucial question, given that b is already known, why would anyone spend more time and energy for measuring the thickness --once again-- using Applicant's method? What Applicant may want to say is, "*The constant b is the thickness of the oxide film, should it have been measured immediately after the film is formed*". Again, this objection is primarily about claim language. How to determine the factor a and the constant b, is well known in the art, and is already addressed in the previous Office Action, i.e., as recited by Bozada et al., Salmon et al., Beaunier et al., and Dorlot et al. (see previous PTO-892). These references also show that the limitations of claims 3, 10, 14 and 21 are well known in the art.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

11. Claims 1, 5-7, 12, and 16-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bozada et al. (USPAT # 6,004,881) in view of Kobayashi et al. (USPAT # 6,221,788).

(11.1) Regarding claims 1, 5, 12 and 16, Bozada et al. discloses a method for measuring thickness of an oxide film, as recited in Col.6/30-37. Bozada's method comprises:

- forming an oxide film on a substrate, as recited in Col.6/ll.18-22;
- measuring an "*exposure period of time from a time at which the thickness of the oxide film is measured*", which is inherent in Col.6/ll.21-36, as represented by the parameter t in Eq.(1) recited in Col.6/ll.35-36;
- measuring the thickness of the oxide film by irradiating the oxide film with light in accordance with the "*exposure period*", as recited in Col.6/ll.30-33 and represented by Bozada's Eq.(1).

Although a step of washing or cleaning the substrate is conventional and also inherent in Bozada's, as generally known to one of ordinary skill in the art, the step is not explicitly recited in Bozada's.

- Especially regarding claims 5 and 16, Kobayashi et al. disclose a step of washing or cleaning an oxide surface to remove the native oxide, as recited in Col.6/ll.27-47. which, when used in combination with Bozada's method, is conducted prior to conducting Bozada's thickness measurements, as understood by one of ordinary skill in the art.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to clean Bozada's oxide surface using Kobayashi's cleaning step prior to conducting thickness measurement, in order not to have the result of measurement falsified by the existence of a native oxide, as taught by Kobayashi et al. In Col.6/ll.33-36, or at least, having a definite starting time point to take into account a re-growth of the natural oxide as a function of time, as implicated by Bozada et al. in Eq.(1).

- Especially regarding claims 12 and 16, the additional steps of "*determining whether the oxide film thickness falls in a desirable range*", and "*performing a succeeding step for manufacturing the semiconductor device when the oxide thickness falls in the desirable range*" are quite trivial for being inherent and/or conventional in every semiconductor manufacturing process (quality control).

(11.2) Regarding claims 6, 7, 17 and 18, Kobayashi et al. teach a method to clean an oxide surface using a solution containing HCl and hydrogen peroxide, thus simultaneously rendering obvious claims 6 & 17 (regarding a solution containing at least one of H_2SO_4 and HCl) as well as claims 7 & 18 (regarding a solution of either H_2SO_4 or HCl with hydrogen peroxide.

12. Claims 2, 3, 9, 10, 13, 14, 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bozada et al. in view of Kobayashi et al., and further in view of Salmon et al. , Beaunier et al., Dorlot et al. and Schell et al. (see previous PTO-892).

(12.1) Regarding claims 2, 9, 13, and 20, Bozada et al. recite all the claim limitations, except the recitation of correcting the thickness of the oxide film based on the "*exposure period*" to obtain a real thickness of the oxide film. However, given the knowledge of apparent thickness increase as shown in Bozada's Eq.(1), tracing back from the apparent thickness to its initial value using such a conventional logarithmic law is one of the most primitive and straightforward way quite obvious to one of ordinary skill in the art. This Official Notice previously taken by the Examiner is here supported by a large number of prior arts, e.g., (1) Salmon et al. (see PTO-892) pg.272/Col.2, Eq.(2), referring to two references (Beaunier et al., 1984, and Dorlot et al. (1986), reciting that the logarithmic law is typical for the growth of thin oxide films, and (2) Schell et al., FZR Report 05/10/1999 (PTO-892), pg.2, Fig.2 + 2 lines below Fig.2

It would have been obvious to one of ordinary skill in the art at the time the invention was made to correct the thickness of the oxide film based on the "*exposure period*" according to Bozada's Eq.(1), since such a corrective action involves only routine skill in the art.

One would have been motivated to obtain the correct oxide thickness, since if this native oxide has grown too thick, it would hamper the function of a semiconductor device, as is conventionally understood in the art.

(12.2) Regarding claims 3, 10, 14, and 21, Bozada et al. as modified by Kobayashi et al. recite all the claim limitations, except the recitation of correcting the thickness of the oxide film by means of a formula which is not invented by Applicant but is widely known

in the art in various forms of empirical formulas, as admitted by Applicant himself on pg.15/ll.17-20, and evidenced by Bozada et al. in Eq.(1).

This Official Notice previously taken by the Examiner is here supported by a large number of prior arts, e.g., (1) Salmon et al. (see PTO-892) pg.272/Col.2, Eq.(2), shown in Fig.3 on page 273, referring to two references also listed in the previous PTO-892 (Beaunier et al., 1984, recited in Eq.8.33 on page 234, and Dorlot et al. (1986), teaching that the logarithmic law is typical for the growth of thin oxide films, as recited in the 4th equation of Section II.1.B(a) on page 329 and Fig.II.5 on page 230), and further, (2) Schell et al., FZR Report 05/10/1999 (PTO-892), pg.2, Fig.2 + 2 lines below Fig.2.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to correct the thickness of the oxide film according to any empirical formula recited in the prior arts mentioned above, since such a corrective action is the most simple and primitive method of correction that only involves routine skill in the art.

Final Rejection

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office Action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Communications

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bernard E Souw whose telephone number is 703 305 0149. The examiner can normally be reached on Monday thru Friday, 9:00 am to 5:00 pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R Lee can be reached on 703 308 4116. The central fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306 for regular communications as well as for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.

bes

November 25, 2003

JOHN R. LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800